Transformations
Opening Activity

Name:_____
Date:_____Period:_____

1. Using your graphing Calculator, graph $f(x)=|x|$ and draw this on your graph paper.
Where does it start? (0,0)

a. Graph $f(x)=|x|+4$, What happened to the graph? UP 4 units
On the same graph draw $f(x)=|x|+4$, with a different color and label it.

b. Graph $f(x)=|x|-4$, What happened to the graph? DOWN 4 units
On the same graph draw $f(x)=|x|-4$, with a different color and label it.

c. Graph $f(x)=|x-3|$. What happened to the graph? RIGHT 3 units
On the same graph draw $f(x)=|x-3|$, with a different color and label it.

d. Graph $f(x)=|x+3|$. What happened to the graph? LEFT 3 units
On the same graph draw $f(x)=|x+3|$, with a different color and label it.

e. Graph $f(x)=-|x|$, What happened to the graph? FLIPPED
On the same graph draw $f(x)=-|x|$ with a different color and label it.

f. Graph $f(x)=2|x|$, What happened to the graph? NARROWED
On the same graph draw $f(x)=2|x|$ with a different color and label it.

g. Graph $f(x)=\frac{1}{2}|x|$, What happened to the graph? WIDENED

On the same graph draw $f(x)=\frac{1}{2}|x|$ with a different color and label it.

f. Using your conclusions from above could you predict what the graph of $f(x)=2|x-5|+2$ would look like. Do not use your calculator.

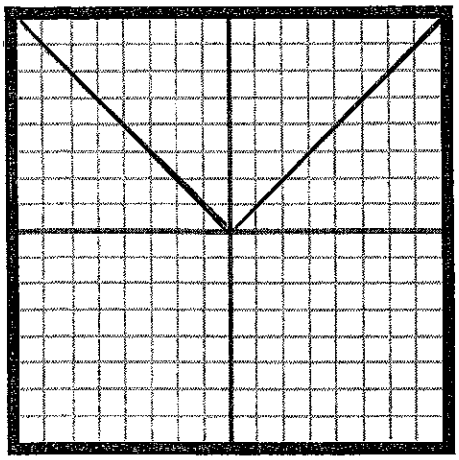
Where do you think it would start? (5,2)

Would it be steeper (closed) or wider (open)? WIDER

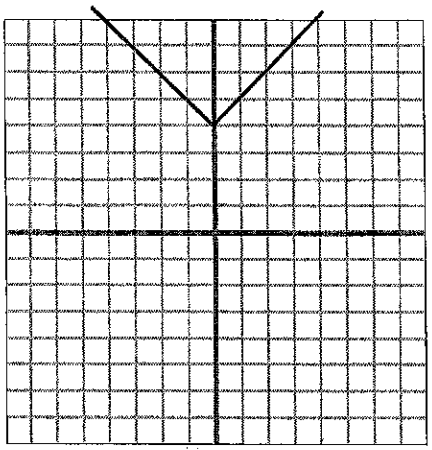
Try to sketch the graph without a calculator and then check your answer with one when you are finished.

What would happen if I put a negative in front , $f(x)=-2|x-5|+2$
FLIPPED

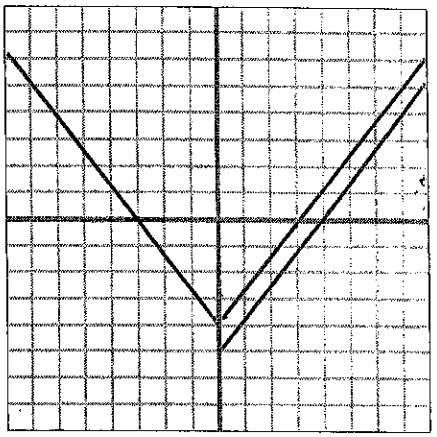
Absolute Value Graphs
Opening Activity



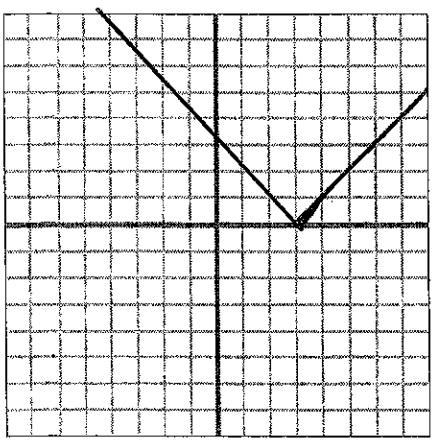
$f(x) = |x|$



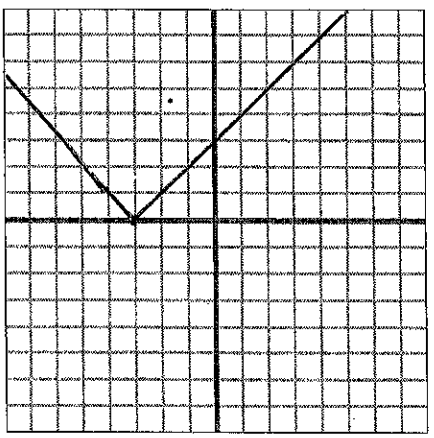
$f(x) = |x| + 4$



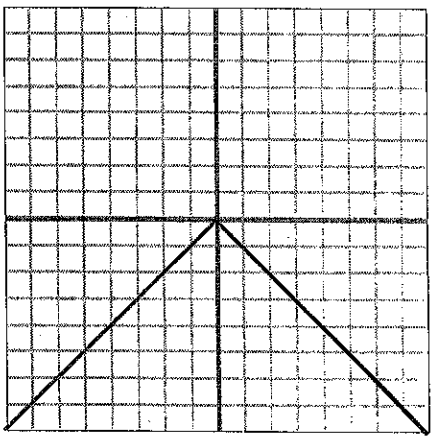
$f(x) = |x| - 4$



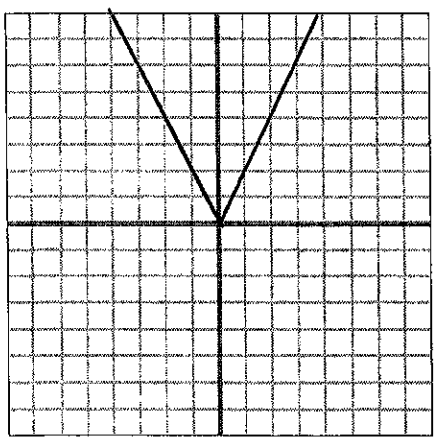
$f(x) = |x - 3|$



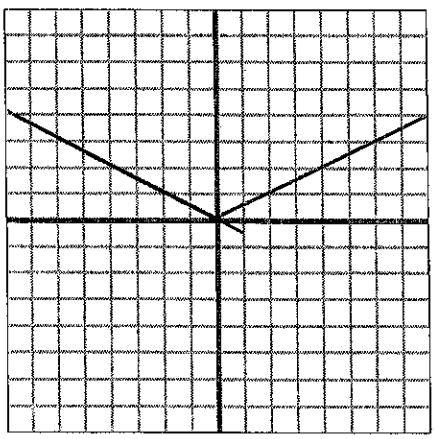
$f(x) = |x + 3|$



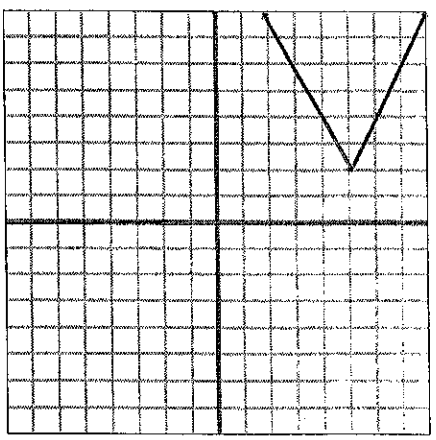
$f(x) = -|x|$



$f(x) = 2|x|$



$f(x) = \frac{1}{2}|x|$



$f(x) = 2|x - 5| + 2$

Algebra 2 5.0
Transformations Notes

Name: _____
Date: _____ Pd: ___

TRANSFORMATIONS

Today we are going to use a function that you have learned a lot about recently. The general form for an absolute value equation is

$$f(x) = a|x - h| + k$$

Think back to the activity you did in class yesterday...Remember how the graph moved when we changed the function $f(x) = |x|$??

VERTICAL SHIFT:

The first two graphs you created yesterday were the graphs of

$$f(x) = |x| + 4 \text{ and } f(x) = |x| - 4$$

How did those graphs differ from the original absolute value graph?

|x| + 4 - 4 units UP ; |x| - 4 - 4 units down

Conclusion:

The "k" value in the equation represents the VERTICAL SHIFT.

The graph shifts UP when the "k" value of $f(x) = a|x - h| + k$ is

POSITIVE.

The graph shifts **DOWN** when the "k" value of $f(x) = a|x - h| + k$ is

NEGATIVE.

HORIZONTAL SHIFT:

The third and fourth graphs you created yesterday were the graphs of
$f(x) = |x - 3|$ and $f(x) = |x + 3|$

How did those graphs differ from the original absolute value graph?
$|x-3|$ - moves right 3 ; $|x+3|$ - moves left 3

Conclusion:

The "h" value in the equation represents the HORIZONTAL SHIFT.

The graph shifts LEFT when the "h" value of $f(x) = a|x - h| + k$ is
NEGATIVE

The graph shifts RIGHT when the "h" value of $f(x) = a|x - h| + k$ is
POSITIVE.

*** Remember the original equation is $f(x) = a|x - h| + k$ ***
(where h is being subtracted).
Therefore if the equation reads $x - h$, h is positive and if the equation reads $x + h$, h is negative!

REFLECTION OVER X-AXIS:

The fifth graph you created yesterday was the graph of

$$f(x) = -|x|$$

How did this graph differ from the original absolute value graph?

reflected over the x-axis

Conclusion:

One of the things the "a" value affects is the direction the graph opens.

The graph opens up when the "a" value is POSITIVE.

The graph opens down when the "a" value is NEGATIVE.

☺ We only consider it a transformation when the "a" value is negative and say the graph is reflected over the x-axis.

VERTICAL STRETCH and COMPRESSION:

The sixth and seventh graphs you created yesterday were the graphs of

$$f(x) = 2|x| \text{ and } f(x) = \frac{1}{2}|x|$$

How did these graphs differ from the original absolute value graph?

$2|x|$ - vertically stretched ; $\frac{1}{2}|x|$ - vertically compressed

Conclusion:

The other change in the graph the "a" value affects is a vertical stretch or compression .

The graph is VERTICALLY STRETCHED when the "a" value is

LARGER than 1.

The graph is VERTICALLY COMPRESSED when the "a" value is

BETWEEN 0 and 1.

☺ We say the graph is vertically stretched or compressed by a factor of

____. (the a value)

Examples:

Identify each transformation from the parent function to the given f(x).

$f(x) = a|x-h|+k$

	Transformation
1. $f(x) = \|x\| - 5$	shifted 5 units - down
2. $f(x) = \|x+6\|$	shifted 6 units - LEFT
3. $f(x) = 4\|x\|$	vertically stretched by a factor of 4
4. $f(x) = -\|x-3\|+7$	"-" reflection over x-axis "-3" shift 3 units RIGHT "+7" - shift 7 units UP
5. $f(x) = \frac{1}{3}\|x+3\|+8$	"⅓" vertically compressed by a factor of ⅓ "+3" - shift 3 units LEFT "+8" - shift 8 units UP

Write the function for each graph described below.

6. the graph of $f(x) = |x|$ translated 9 units to the right.

$S(x) = |x-9|$

7. the graph of $f(x) = |x|$ vertically compressed by a factor of $\frac{1}{5}$.

$S(x) = \frac{1}{5}|x|$

8. the graph of $f(x) = |x|$ vertically stretched by a factor of 8 and translated 3 units down.

$S(x) = 8|x|-3$

9. the graph of $f(x) = |x|$ reflected over the x-axis and translated 1 unit to the right.

$S(x) = -|x-1|$

10. the graph of $f(x) = |x|$ translated 25 units down, 19 units to the left, vertically stretched by a factor of 3 and reflected over the x-axis.

$S(x) = -3|x+19|-25$